I. Perform HIGH POT Test.

II. Set all controls to FULL, Monitor to FULL VOLUME and install Pedal plugs at rear panel.

A. Check Noisiness & feel of
   1. Power On-Off - Preset 8 always comes on first.
   2. All Slide Pots (in "ON" & "VAR" modes)
   3. All Preset Buttons Clav is noisest. Pre 7
   4. All Variable Buttons & their related LED function

Turn Volume to Zero.
Bleed through w/ Vol to Zero on all Presets.

B. Check Keyboard for
   1. Appearance
   2. Noisiness
   3. Feel

APPROVED

Turn On Pre 5 and Set Volume to Listening Level.

C. Check Keyboard for
   1. Dynamic Consistency
   2. Dynamic Range
   3. Double Triggering
   4. Response to Fast Multiple Triggering
   5. Response to Fast Runs (Hanon Studies, No.1)

Turn On Pre 9. - Bleed through direct out, gen. strong filters

D. Check Every Key for
   1. Clean Attack
   2. Presence & Clarity of Sawtooth

Turn On Pre 13 & Turn Modulation to Variable with Rate & Amount to Zero.

REVISIONS:	ISSUE	REVISIONS:	ISSUE
9/05/78	A		

moog MUSIC INC.

MANUFACTURING STANDARD

DRAWN: 1-5-78

APPROVED: RWW

TS 997-042604-001

5. Left Hand Control Board - Connect headphone Monitor and H.P 400f AC voltmeter to Main Output

a.) Variable Attack - In preset 9, variable attack pot fully up. Repeatedly depress a note. Depress Attack Var switch and note change from fast to slow attack. Depress Attack Pre switch and note return to fast attack. Also observe proper operation of LED indicators.
Presets 1, 2, 3, 9, 10, 11

b.) Variable Modulation - In preset 1, variable modulation pot fully down, Depress E63 and depress Modulation Var switch and note that modulation ceases. Depress Modulation Pre and note that modulation returns. Also observe proper operation of LED indicators

c) Bass Filter - with Bass Level control fully up and Bass Cut control Fully down, depress E2. Depress Bass Filter On switch and note change to "bassy" tone. Depress Bass Filter off and note return to normal tone. Also observe proper operation of LED indicators. Main out on Back of unit.

d.) Bass Filter Rear Panel Switching - With Bass Filter on Depress E2. Insert dummy plug into rear panel Bass Output jack and note no more than -60 dbm residual output from E2. Connect Headphone monitor amp to Bass Output jack and note Bass sound. Depress Bass Filter Off and note no sound. Wrong main outs; If failure occurs replace 4016.

6. Top Right Board Control Circuits and Master Voice Selector -
Connect head phone monitor to main output.

a) Presets - Check each preset for proper voicing. Use the following chart as a guide. Also note that all preset switches operate smoothly quietly and without excessive clicks in audio and that 1½ digit LED display light properly

b) Foot Sustain - Insert a shorting plug into the rear panel foot sustain jack and check each presets 3-19 for added release Use the following chart as a guide. Remove shorting plug

c) Variable Modulation - Check the operation of the variable modulation rate and amount pots for each preset in variable modulation mode. Pots should have no effect in preset mode. Use the following chart for reference.

d.) External Modulation Amount - In modulation variable, modulation amount fully up, insert shorting jack into rear panel Mod Amount jack and observe that modulation amount is zero. Remove Shorting Plug

e) Variable Loudness Attack - Check the operation of the variable Attack pot for presets 1, 2, 3, 9, 10, and 11 in the variable attack mode. Pot. should have no effect in preset mode.

						PRE
	LOUD CONTOUR	ATT		FAST SLOW KB DYN		
		DEC		FAST SLOW NONE		
				SUSTAIN		
		REL		FAST MEDIUM SLOW		
	WAVEFORM			WIDE NARROW 16', 8'		
				8', 4', 2⅔', 2'		
	OSC			LOCK FREE DETUNE		
	MOD			WIDTH FREQ PHASE		
				FREQ		
				BRIGHT HI BRIGHT LO		

F - RELEASE WITH FOOT SUSTAIN
D - MODULATION IN PRESET ONLY
V - MODULATION IN VARIABLE ONLY
A - PRESET AND VARIABLE AMOUNT ONLY

7. Top Right Board Monophonic Keyboard Circuit — Connect DVM to rear panel Keyboard Output Jack and load output with a 4.7K resistor to V-. Connect Scope to rear panel S-trig Output and load output with a 1K resistor to V+. Set Rear panel Glide Control fully counterclockwise and Rear Panel Range and Scale controls centered

a.) Range - Turn rear panel Range control fully clockwise. Depress F_1 repeatedly, voltage should be -100 to -600 mVDC. Turn Range control fully counter clockwise, Depress F_1 repeatedly, voltage should be +100 to +600 mVDC. Adjust range to 0.0VDC +0-10 mV at F_1.

b.) Scale - Turn Scale control fully clockwise, Depress F_6 repeatedly, voltage should be +5.25 to +5.75 VDC, Turn Scale control fully counterclockwise. Depress F_6 repeatedly, voltage should be +4.25 to +4.75 VDC, Adjust scale control for 5.00 VDC +10 -0 mV for F6.

c.) Drift - Depress E_1 twice and check that keyboard voltage does not drift more than 1 mV/sec. Depress $D_\sharp$ twice and check that keyboard voltage does not drift more than 1 mV/sec.

d.) Glide - Turn rear panel Glide control fully clockwise. Depress F_6 twice. Depress F_1. Time to reach 0V should be 3.75 to 8.75 seconds. Depress F_6. Time to reach 5 V should be 3.75 to 8.75 seconds.

e) External Glide On-Off - With rear panel Glide control full clockwise, insert shorting plug into rear panel Glide On-Off jack. Observe 0 glide time between notes.

f.) Multiple Triggering. In preset [illegible], rear panel Single-Multiple switch to Multiple, depress and hold 5 notes. Observe S-trig output drop from V+ to 0.0 VDC +50mVDC -0mVDC. Depress a 6th note and observe positive retrigger pulse of 4 to 10 ms duration.

g.) Single Triggering. In preset [illegible], rear panel Single-Multiple switch to Single, depress and hold 1 note. Observe no retrigger pulse when pressing additional notes.

h) Ext. Trig Mode - In preset #9, rear panel Single-Multiple Switch to Multiple, depress several notes and observe multiple triggering. Insert shorting plug into rear panel Trig Mode jack and observe single triggering. Remove Shorting Plug.

i) Contour Generator - Connect Scope probe to P910 pin 10. Depress a key and note that the voltage should attack to 7.5 VDC ± 1.0 VDC in 53 ms ± 5 ms, then should immediately begin to decay with a time constant of 250ms ± 50ms to a level of 3.50 v ± .18 VDC. On release of the key the contour should fall with a time constant of 250ms ± 50ms to 0v. Depress Variable attack switch and note increase in attack time as pot is moved upwards. Pot should have no effect in Preset mode

8. High Frequency Oscillator, Divider, Mother, Modulator and Balance Boards - Connect Headphone Monitor, A.C. voltmeter, and Scope to Direct Output direct out.

a.) Saw Level - In preset 9, check for less than 3 db difference in output level between adjacent notes

b) Pulse width - Disconnect S11 (on Saw high Frequency oscillator). In preset 7, check each key for uniform pulse width.

c.) High Frequency Pulse - With S11 disconnected, inject 1 volt into rear panel Pitch jack. In preset 7 check each key for output. Reconnect S11

d.) High Frequency Saw - Inject 1 volt into rear panel Pitch jack. In preset 11 check for saw output on each note. Remove external pitch control

e.) Dynamics - In preset 6 check each key for uniform ~~[illegible]~~ dynamics.

f.) Decay - In preset 13 check each key for uniform decay ~~normal~~.

g.) Release - Insert shorting plug into rear panel sustain jact. In preset 8 check each key for uniform release (foot sustain). Remove shorting jack

h.) Filter Caps - In preset 12 check each key for proper sound

i) Bleed through - In preset 1, without pressing any keys, wait 60 seconds and listen for notes to sound. gain at map.

j) Balance Curbs - Depress 10 keys on one mother board. Listen for crackling, distortion, or sound dying away. Repeat for all mother boards and all presets

Note: While running above tests also check for smooth uniform feel of keyboard.

9. Audio Circuit Board - Connect headphone monitor and frequency counter to main output.

a) Bass Filter - check operation of Bass Filter level and Cut Freq controls in Bass Filter On mode. Controls should effect notes below E5 only and should have no effect in Bass Filter ~~Off~~ mode. (Bass filter controls may ~~effect~~ noise level slightly).

b) VCF Cutoff - In preset 9, Volume control fully, headphone volume control fully down, connect a series 10kΩ resistor and .33μf capacitor between P83 pin 1 and IC5 pin 2. Press and release F6 and observe 200 hz oscillation. Adjust R44 if necessary. Press lower notes and observe decreasing frequency.

c.) External VCF Cutoff - With same set up as step b. depress F6 and observe 200 hz oscillation. Inject +1.00VDC ± 5mV DC into rear panel Filter jack and observe frequency increase to 400-800hz. Remove R-C network and external cutoff control.

d.) VCF Audio - Listen to presets 9 and 10 for proper tone and filter contour.

e.) Monophonic Keyboard - In preset 9 check each note for triggering and tracking of VCF.

f.) Swell Range - Adjust R11 for -1 db from full output. Insert Shorting plug into rear panel Swell jack and observe reduction in output level of 30 db ± 3 db. Remove Shorting Plug

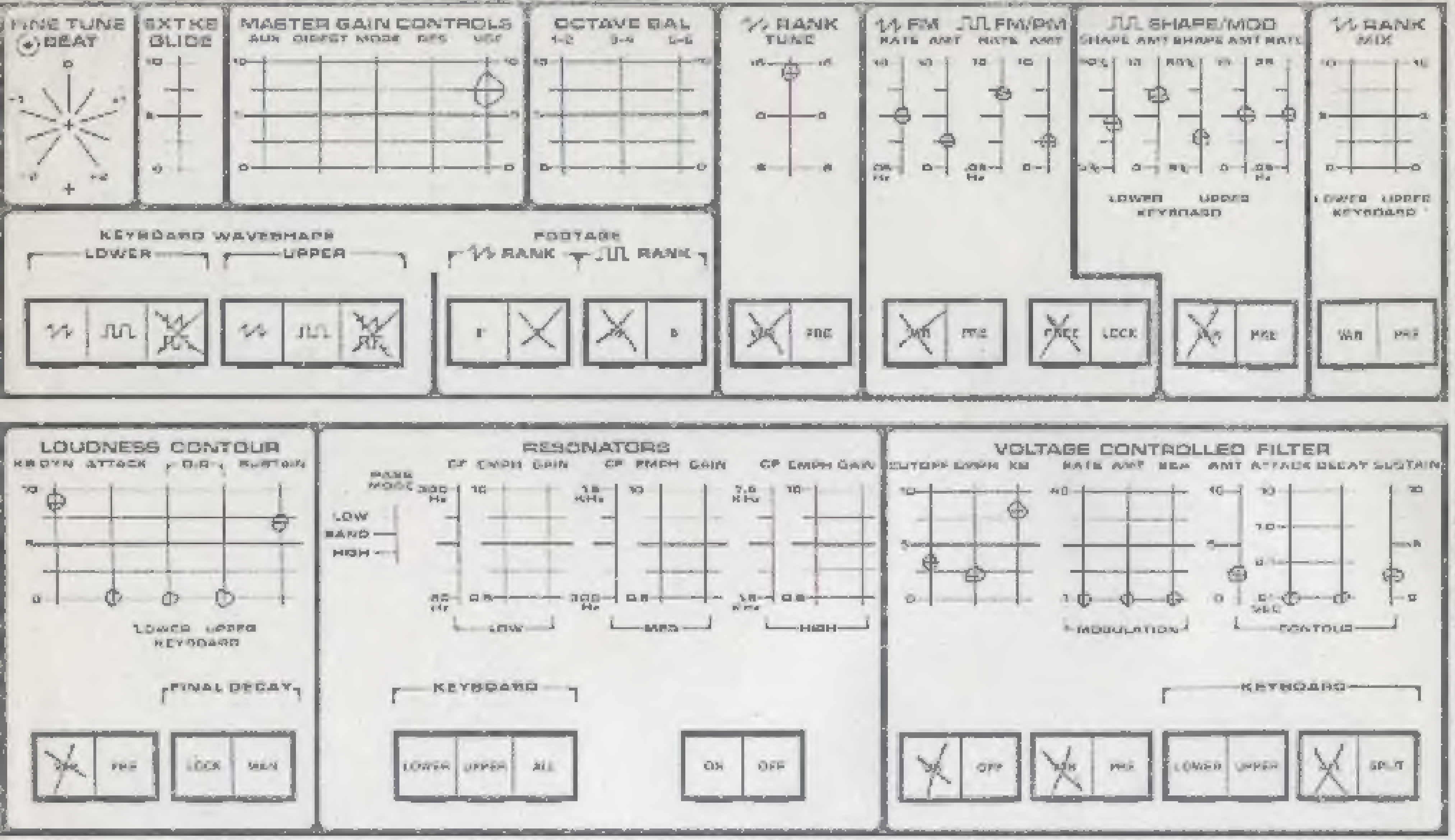
g.) Volume Controls - verify smooth, noise free operation of front panel volume and octave balance controls.

h.) Preset Filters - Listen to presets 1-8 and 11-14 and check for proper filtering.

Note: Filter boards cannot be adequately repaired at final test. Return defective boards to board test and replace with tested boards.

10. Noise - connect A.C. voltmeter to the appropriate output, and check for the following maximum noise levels (dbm).

PRE	DIRECT	MAIN	BASS
1	-78	-84	-72
2	-82	-81,5	-78
3	-79	-83	-73
4	-83.5	-81	-81
5	-83.5	-80	-82
6	-83	-81,5	-79
7	-82	-81	-78
8	-78	-83	-73
9	-84	-77	-84
10	-84	-76	-81
11	-83	-83.5	-78
12	~~-80~~ -55	-83,5	-75
13	-82	-78	-79
14	-82	-79	-78



NOTES. Custom Voice for Eric Enfield? Preset #3 (Hammond w/ 15 four drawbars out & perc. on)

Function	Voltage	Location	[illegible]
Rank Tune	3.05v	N1 Lin	R=1[illegible]
" FM Rate	1.2v	N2	1M
" Amt	.3v	N5	1.5M
⊓⊓ Fm/Pm Rate	7.5v	N3	22k
" Amt	.3v	N6	150K
Shape Low	7.0v	N8	33K
Amt Low	3.0v	N9	36K
Shape Hi	5.0v	N10	49K
Amt Hi	.9v	N11	130K
Rate	1.2v	N13	680K
KB Dyn	7.2v	N13 Rev	[illegible]
Attack	0v	N14	[illegible]
Sustain	7.0v	N11	150K
Cutoff	4.5v	N8	[illegible]
Emph	6.0v	N4	[illegible]
KB	11.8v	N10	[illegible]
Envelope Amt	2.4v	N4	91K
Attack	0v	N7	[illegible]
Decay	0v	N8	" "
Sustain	8.3v	N6	43K

R.C.H.Bd
Preset Voicing Changes.

23-24 N1. Add R1 33K, Mod Amt

22/23 N2. Add R1 33K, R_5 200K → 100K, R7 150K to 220K, Rate.

16/17 N3 Add R1 62K. R_3 200K to 9K, CUTOFF.

20 N4 Add R_1 20K, Omit R8 27K, R_5 12K to 15K, omit R_3 13K, 13K R from Pin 10 of N4 to Emph. ↓

26 N5 SAmple + Hold

29/30 N6 ~~Add~~ R_3 24K to 27K, Sustain.

22 N7 Add R3 9.1K to 10K, ATTACK-FILTER

28/29 N8 Add R_3 TO 200K, Decay.

27 N9 Omit R1 12K, Add R_3 51K, omit R7, CONTOUR AMT.

21 N10 Add R_3 27K Kybd Amt.

16 N11 Add R_7 150K, R_5 85K → 82K, Bright

15 N12 Add R_2 100K, omit R7, R_5 75K clamp Level

N13 Add R_2 75K, R_7 100K, R_5 24K, Dynamics.

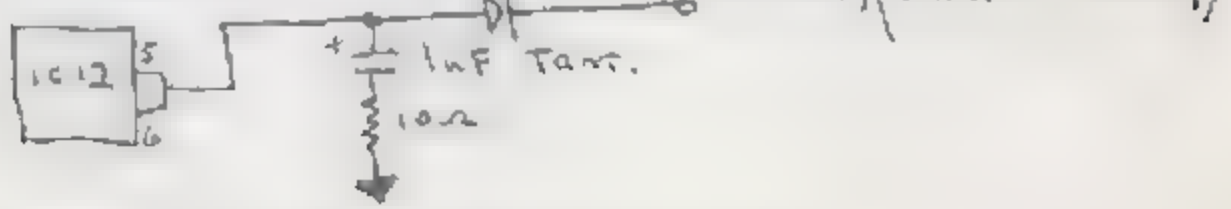
N14 Add R_1 120K, R_2 27K, R7 30K, R_5 51K. up Decay

13 N15 Add R_1 110K, R_2 27K, R7 30K, R_5 51K. Lo Decay

12 N16 Attack, Kybd.

14/15 N17 Add R1 110K, R_3 130K, omit R_2, R_5 TO 240K. Sustain.

2.) ADD, Res, Diode + cap as indicated



L.H.C. PRESET VOICINGS

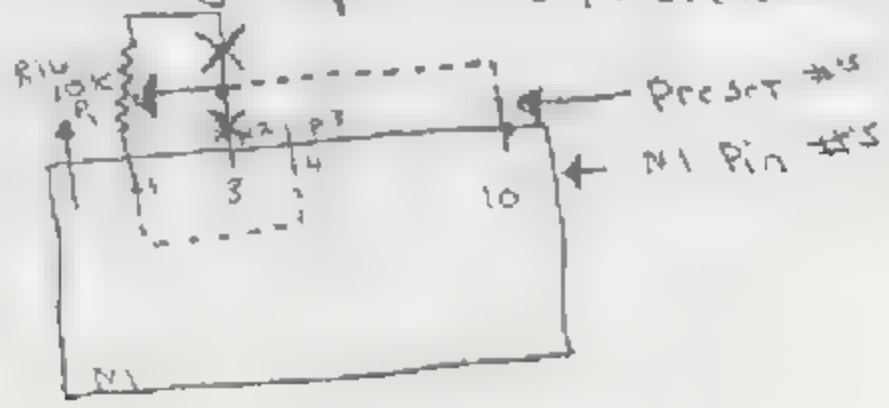
①

N1 - TUNE.
N2. FM M RATE.
N3. " IL "
* N4. R_2 33K, Level Lo
N5. FM M AMT.
N6. " IL AMT.
*N7. R_2 33K Level Hi.
*N8. R_2 47K Shape Lo
N9. Lo Mod.
*N10. R_2 47K
N11. Hi Mod
*N12. R_2 56K, Shape Med
N13. FM/PM AMT.

② CUT TRACES + ADD JUMPER AS INDICATED ON N1 TUNE NETWORK

A. YS ARE TRACE CUTS

b. DOTTED LINES INDICATE JUMPERS.

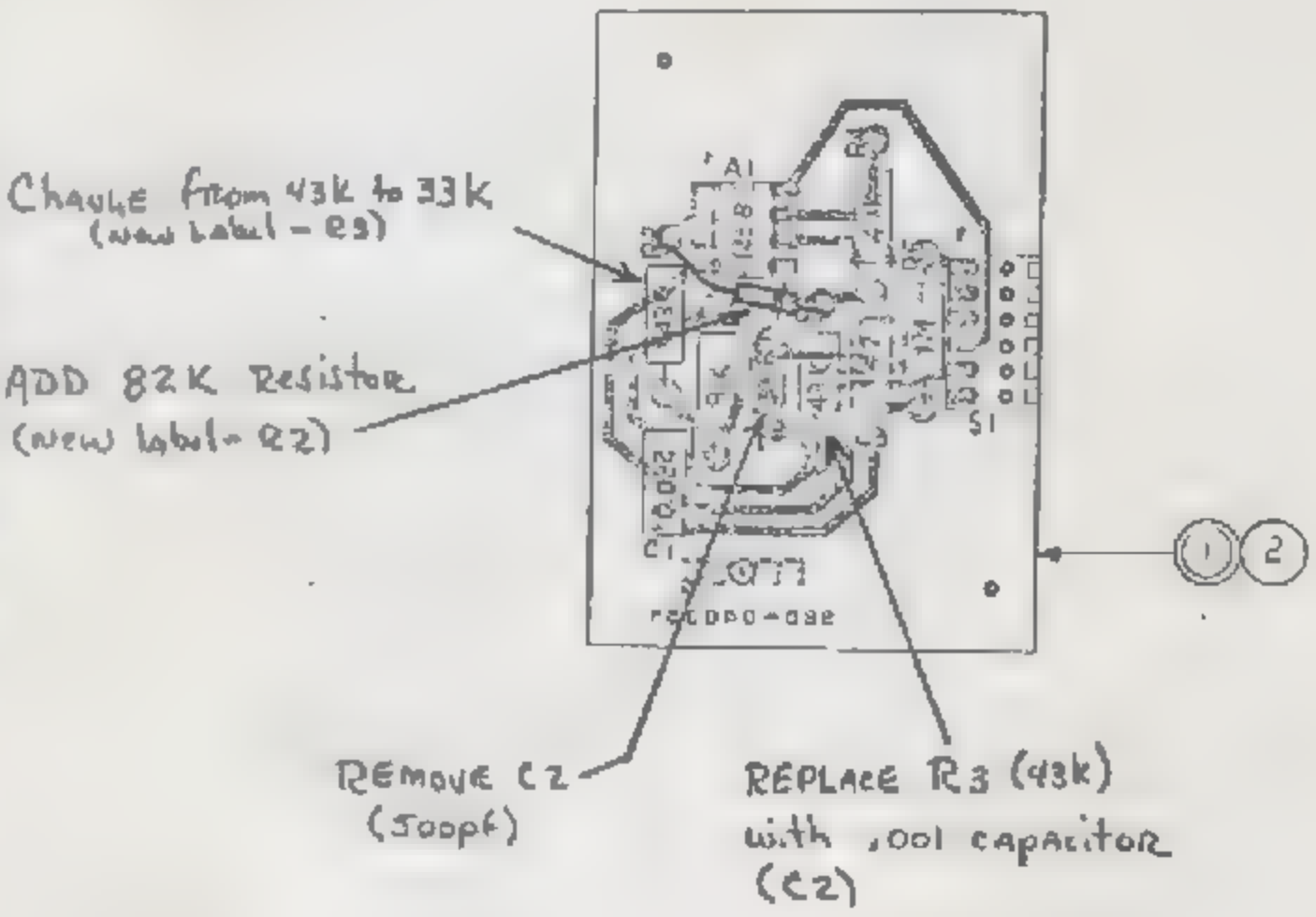


E. Check Squarewave on All Notes for
   1. Presence
   2. Consistency
   3. Clarity
   4. Proper Decay Rate

APPROVED

F. Check Functions in the Following Manner
   1. Slide Mod Amount Pot from zero to ten & listen for increase. (Leave on ten.)
   2. Slide Mod Rate Pot from zero to ten & listen for increase. (Leave on ten.)
   3. Press Preset 1 and play a note. Depress Mod Var and listen for change.
   4. Repeat step 3 for Pres. 4-14. Turn Rate & Amount to zero & repeat step 3 for Pres. 2 & 3.
   5. Check Presets 1-3 & 9-11 for Var Attack from 0-10. Attack will affect a change in VCA Attack, Cutoff Frequency & Output Level.
   6. Press Pre 9 and use lower keyboard to check Bass Filter On/Off Function, level & cut Frequency Pots. (Leave "ON".)
   7. Check Octave Balance 1-2 for no effect, turn Bass Filter OFF and check all Octave Balance Pots for effect on respective keyboard output.
   8. Lower Swell Pedal to zero & check Volume Pot from 0-10. (Return volume to previous level and swell pedal back to full.)
   9. Check Ribbon for
      a. Appearance
      b. Centering
      c. Smoothness of performance
   10. Check control of Filter Cutoff with pedal & control of Single Mult Trig with both sw. & foot pedal. (Sw. must be in Mult. position in order to check pedal.)
   11. Press Pre 8 & raise pitch one octave with pedal. Check every note to be certain square width is modulating normally.

Modification of older version string mode filter to newer version.



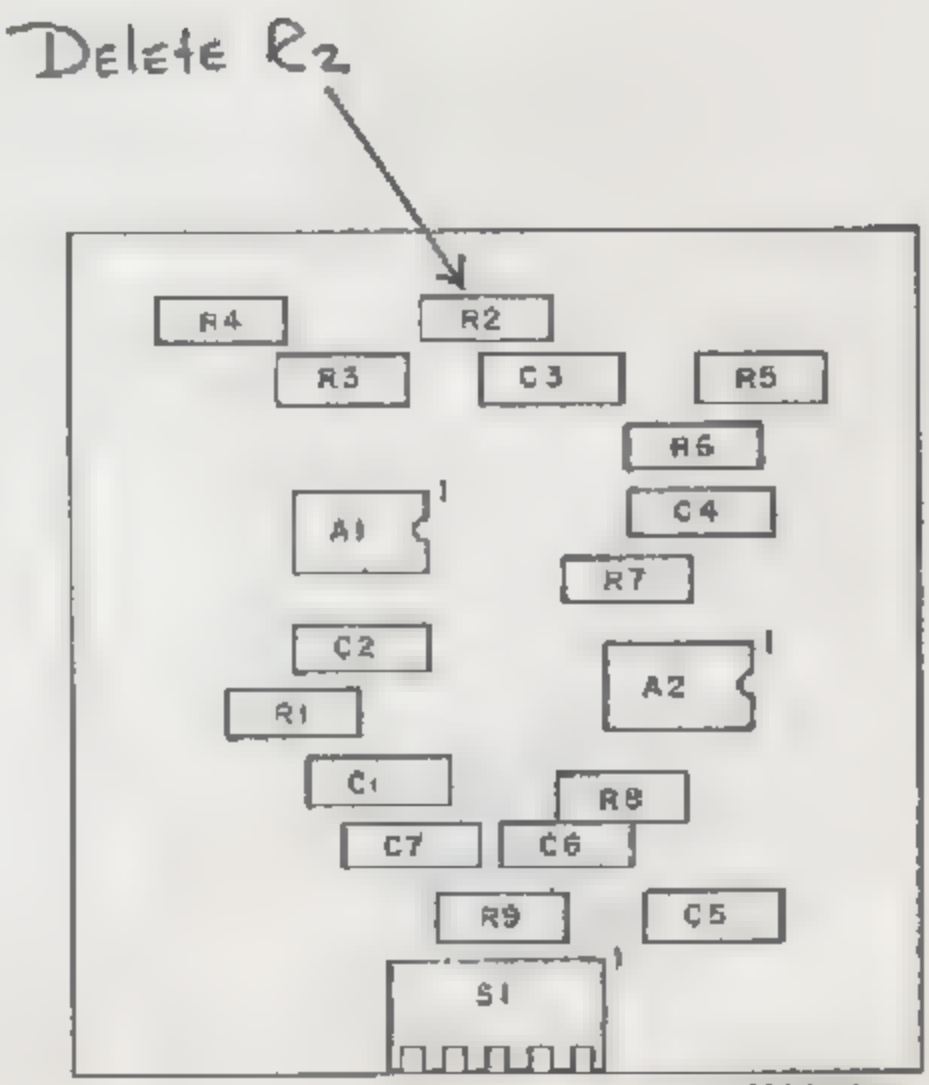
NOTES

1. CIRCUITRY SHOWN IS ON FAR SIDE OF BOARD.
2. UNLESS OTHERWISE SPECIFIED -
   ALL RESISTORS ARE IN OHMS 1/4W, ±5%.
   ALL CAPACITORS ARE IN MFD (µf).

Poly Synthesizer - 5-24-79

NOTE:

REFER TO THE REPLACEMENT PARTS LIST IN SECTION 10 FOR THE PART NUMBER AND DESCRIPTION OF EACH REFERENCE DESIGNATOR.



Poly Synthesizer 5-24-79

PIANO FILTER BOARD NO. 2 PRINTED CIRCUIT BOARD ASSEMBLY

REFER TO THE
PARTS LIST IN
SECTION 9 FOR

MAP 101

DWG 8/21/11

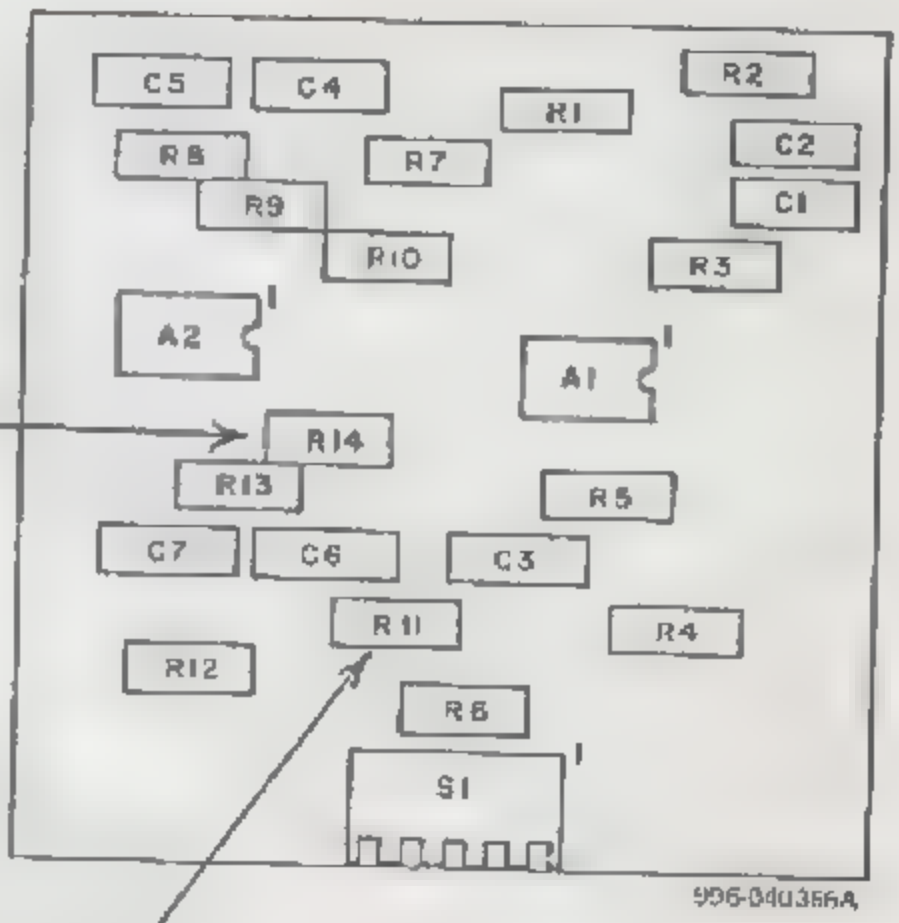
PAT. 4

SWELL
RANGE

KEYBOARD
ACTION
BALANCE
RAIL

NOTE:

REFER TO THE REPLACEMENT PARTS LIST IN SECTION 10 FOR THE PART NUMBER AND DESCRIPTION OF EACH REFERENCE DESIGNATOR.



Change from 22K to 110K

Change from 240k to 47K

Poly synthesizer 5-24-79

FUNK FILTER BOARD NO. 5 PRINTED CIRCUIT BOARD ASSEMBLY

11. Con't:
(Will cut out sometimes.)
12. Press Pre 3 & holding Sustain Pedal down play every note, listening for sustain.
13. Check voicings of 3-14 with & without sustain. (All three sections.)
14. Check voicing of 1 & 2 (All three sections.)
15. Press Pre 1 & turn Volume to full. Wait 1 minute and listen for bleed through.
16. Reset Pre 1 & turn all modulations off. Check range of Beat Knob & corresponding LED function. Should zero beat between ±.5 on scale.
17. Check range of Fine Tune Pot. Should be greater than ± 1/2 semitone.

Test complete.

APPROVED

10/12/78

Poly II

HFO Resistor Select Procedure

① Connect Poly Pedal to unit
- Pitch Led on
- Pitch Pedal Min
- Pre #2 (String 1)
- Attack Var, Slider Down
- Modulation Var, Sliders Down

Square HFO Select

① Remove Saw HFO Bd RT BJ

② Depress A_4 (440 Hz)

③ Pitch Pedal Max (>3 Vdc @ Pitch Jack)

④ Remove Square HFO Bd + Lift Left Side of 1.5 K Res

⑤ Connect R Box between 1.5 K Res + Emitter of Darlington Trans (Top Leg next to .47 μf Cap)

⑥ Insert Square HFO Bd
- Press A_4 + Adjust R Box for a Freq of 880 Hz (+100 Hz, -0 Hz)

⑦ Remove 1.5 K Res + Insert a Resistor with a Value Closest to ≤1.5 K + R Box

⑧ Depress A_4 + Check Range with Pitch Pedal
- Min 440 Hz
- Max 800 Hz (+100 Hz - 0 Hz)

Saw HFO Select

Remove Square HFO Bd + Repeat Steps A → G As Above using Saw HFO Bd

(Note Long Sustain is norm w/ Sq HFO out.)

Primary Keyboard Pre Burn in Test Procedure

Power Supplies - Apply primary power to instrument
Connect DVM negative lead to pin 2 of accessory
connector on rear panel.
Preset 8 always comes on first.

a) +5 V Supply - Connect positive lead of DVM to
pin 1 of rear panel accessory connector and observe
+5.0 VDC ±10mV DC. Adjust R18 on power supply
assembly if necessary.

b) +12 V Supply - Connect positive lead of DVM to
pin 3 of rear panel accessory connector and observe
+12 VDC ±10mV DC. Adjust R8 on power supply
assembly if necessary.

c) VCC Supply - Connect positive lead of DVM to
pin 5 of rear panel accessory connector and observe
+5 VDC ±10mV DC. Adjust R33 on power supply
assembly if necessary.

d) VCC Supply - Connect positive lead of DVM to
TP2 pin 1 (top center board) and observe
+5 VDC ±10mV DC. (VCC supply is located on top center board)

e) -5.2 V Supply - Connect positive lead of DVM to
TP11 pin 3 (top right board) and observe
-5.2 VDC ±65mV DC. (-5.2 V supply is located on
the vertical board)

2. Top Left Board Operating Checks - Connect head phone monitor amp to direct output.

a.) Pulse Frequency Modulation - In preset 13, depress Eb 3 and listen for pulse frequency modulation

b.) Pulse Width Modulation - In preset 12, depress Eb3 and listen for pulse width modulation

c.) Phase Modulation - In preset 11, modulation variable, modulation amount fullup, depress Eb3 and listen for phase modulation.

d.) Saw Frequency Modulation - In preset 9, modulation variable, modulation amount fullup, depress Eb3 and listen for saw frequency modulation.

Note: Any Repairs to modulation sections of top left board will require realignment of repaired section, Refer to service manual for procedures.

3. Top Left + Board Alignment Checks -

a.) Drive Limit Level and Sawtooth Level - Unplug connector S72. With DVM check voltage at A24 pin 1 for 4.1 VDC ±50mVDC. Adjust R108 if neccessary. Check voltage at pin 7 of A25 for 5.1 VDC ±100mVDC Adjust R114 if neccessary. Check voltage at pin 1 of A25 for 5.1 VDC ±100mVDC Adjust R120 if neccessary. Reconnect S72.

b) Decay Set - Unplug connector S75. With DVM check voltage at pin 7 of A26 for 3.74 VDC ± 20mVDC. Adjust R126 if neccessary. Check voltage at pin 1 of A26 for 3.74 VDC ± 20 mVDC. Adjust R127 if neccessary. Check voltage at pin 6 of A27 for 3.64 VDC ± 20 mVDC. Adjust R132 if neccessary. Reconnect S75.

c.) Pulse Width set - Unplug connectors S77 and S72. With DVM check voltage at pin 1 of A28 for 9.00 VDC ± 50 mVDC. Adjust R138 if neccessary. Check voltage at pin 1 of A29 for 9.00 VDC ± 50 mVDC. Adjust R145 if neccessary. Check voltage on pin 1 of A30 for 9.00 VDC ± 50 mVDC. Adjust R152 if neccessary. Reconnect S77 and S72

d.) Attack Set, Sustain Level Set, and Lowest Level Set - Unplug connector S78. With Scope, monitor pin 1 of I.C. 10A and adjust R165 so that pulse just barely disappears (zero pulse width). Monitor P79 pin 1 and observe approx 20 khz square wave. Check for peak to peak voltage of 1.2 V ± 50mv. Adjust R174 if neccessary. Ground the emmiter of Q_{11}. With DVM check voltage at P79 pin 1 for -3.60 VDC ±10 mVDC. Adjust R182 if neccessary. Remove Q_{11} ground and reconnect S78

4. Tune Up and Pitch Controls - Connect Frequency counter to direct output and center front panel Fine Tune and Beat Rate controls.

Note; Reference Oscillators should not be tuned unless unit has had power applied continuously for at least 5 minutes.

a.) Oscillator 1 Tuning - In preset 9, depress A4 and check for a frequency of 440hz ± 1hz. Center R59 (Osc 1 Scale) and adjust R51 (Osc 1 Range) if necessary

b.) Oscillator 2 Tuning - In preset 3, modulation variable, modulation amount fully down, depress Eb 5 (1244.5hz) and observe 0 beat rate. Depress Ribbon Controller such that pitch is raised a musical fifth (1864.4 hz) and observe a beat rate no higher than 1 beat in 2.7 seconds. If not, depress high point of Ribbon and adjust R76 (Osc 2 Range) for 0 beat rate. Release Ribbon and adjust R80 (Osc 2 Scale) for 0 beat rate. Repeat adjustments until 0 beat rate with no pitch change and less than 1 beat in 2.7 seconds with pitch raised a musical fifth can be achieved.

c.) Ribbon Range - In preset 9, depress A4 (440 hz). Depress right end of Ribbon, pitch should rise to 739-831 hz. Depress left end of ribbon pitch should fall to 235-262 hz.

d.) Ribbon Quality - Check full length of Ribbon controller for smooth skip free operation and no pitch change at center. Else between the interval of ± a musical fifth, the beat rate should not exceed 1 beat in 2.7 seconds. Return to step 4b. if necessary.

e.) Fine Tune Control - In preset 9, depress A4 (440 hz) Turn Fine Tune control fully clockwise, frequency should increase to 453-466 hz. Turn Fine Tune control fully counter clockwise, frequency should fall to 427-415 hz. Control should operate smoothly over full range. Return control to center position

f.) Beat Rate Control - In preset 1, modulation variable, modulation amount fully down, depress Eb 5. Listen for smooth operation and centering of Beat rate control and operation of Beat Rate LED. Return control to center position.

9. External Pitch Control - Inject +1.90 VDC ± 5 mVDC into rear panel Pitch jack. Depress A-440 pitch should be 880 hz ± 3 hz. Remove external pitch control.